

## HEATED BLOW MOULD FOR THERMOSTABILIZING TREATMENT

### Technical Field

This invention relates to a heated blow mould for the thermostabilizing treatment or the heat-set process. More specifically, it relates to a blow  
5 mould where the heating element consists of at least a set of tubular electric resistors connected to each other.

### Background Art

Today, plastic containers in different shapes and sizes – for example, bottles – are often made with a process comprising a blow moulding  
10 stage wherein the thermoplastic material, possibly in the form of a preform (i.e. a smaller, pre-moulded workpiece that is normally cylindrical in shape), is blow moulded in a heated mould to create the final container.

To date, two general known systems are used to heat the mould: the  
15 first uses film electric resistors placed near the inside surface of the mould, and the second uses a heating element consisting of a hot fluid that circulates in a coil placed in the mould.

Although the heating system with film electric resistors (described, for example, in US patents 5.007.818 and 5.234.637) has excellent  
20 temperature modulation properties, it has a poor heating value. As a result, this type of heating system must be placed as near as possible to the surface of the mould that comes into contact with the material to be moulded. The drawback of this requirement is that it is necessary to have several moulds (i.e. one for each type of container or bottle to be  
25 moulded) equipped with a blanket of film electric resistors near the work surface; obviously, this increases costs.

The heating system with the circulating hot fluid has greater thermic inertia than the other system, although it has a good heating value. Furthermore, in today's rotary moulding machines, it presents  
30 significant problems in terms of assuring the watertightness of the location where the fixed and the rotary parts come into contact and of the ducts that convey the hot fluid, generally oil, to the mould, which

opens to house the preform and closes to unload the finished product at high rates. These requirements add bulk to the machine and, thus, mean larger dimensions and higher costs. Another drawback is the poor thermal efficiency due to the dissipation of the thermal power in the rotary device since it is not possible to prevent the ducts for delivering the hot fluid from being far away from those for removing the cold fluid.

Today, thus, there is a need for a mould heating system for use in rotary blow moulding machines that is simple and effective.

#### 10 **Objects and Brief Description of the Invention**

It is an object of this invention to provide a single electric heating system that resolves the aforementioned problems and is suitable for use with any type of container or bottle, easy to control, and energy efficient.

15 The blow moulding device in accordance with this invention consists of a single mould holder that houses, each time, the mould specific to the container (for example, a bottle) to be made. Furthermore, the device consists of a heating system that is housed between the mould holder and mould. Said system consists of at least a set of tubular electric resistors, which are placed parallel to each other and the generator of  
20 the container or bottle, and of other electric resistors, which are normally placed transversal to said first resistors and in areas where more power is dissipated or at least in areas requiring more electric power. Said tubular electric resistors can be connected electrically to  
25 said additional electric resistors.

If necessary, at least one of said sets of tubular electric resistors can be placed nearer the inside surface of the mould holder that is in contact with the mould.

At least another of said sets of electric resistors can be placed nearer  
30 the outside surface of the mould holder in order to limit the outward dispersion of heat, insuring greater thermal uniformity inside the mould.

A layer of thermally insulating material can be used in order to limit further useless and costly losses of heat in the environment.

#### **Brief description of the drawings**

- Figure 1 shows a perspective view of half the mould holder and  
5 mould assembly,
- Figure 2 shows an exploded perspective view of the assembly depicted in Fig. 1, and
- Figure 3 shows a mould holder with a system of tubular electric  
10 resistors in accordance with the invention adhering to the inside surface of said mould holder.

#### **Detailed Description of the Invention**

Other objects and advantages of the invention shall be readily apparent from this more detailed description of the currently preferred versions of the invention, given as nonlimiting examples of the scope  
15 of the invention and in conjunction with the accompanying schematic drawings.

In the blow moulding machines suitable for the device in accordance with the invention, the moulds are of the split-mould kind (i.e. divided into two symmetrical halves) that open to house the preform and  
20 unload the moulded product and close and are clamped tightly during moulding.

Only one of said halves is shown in the figures, since it is taken for granted that the other half is perfectly symmetrical. This symmetry is limited to the geometry. In practice, since heat exchanges with the  
25 outside environment are typically asymmetrical, power must be supplied in an asymmetric way for the two mould halves to have a thermal symmetry; this supply is managed automatically by the control system. The results of the thermostabilizing treatment is to obtain uniformity throughout the surface of the container, even if the shape of  
30 the container is not symmetrical (for example, containers with handles).

Figure 1 shows a shell half (1) of the mould holder that houses a shell half (2) of the mould that, in turn, features an inside mould cavity shaped like the container (for example, a bottle) to be made. A thermally insulating wall (3) decreases the losses of heat, generated by the electric resistors, into the environment.

Figure 2 shows, between the mould holder (1) and mould (2), the placement, near the mould (2), of a first set of tubular electric resistors, which are parallel to each other and to the generator of the inside cavity of the shell half (3', 4', 5', 6', 7', 8'), connected to each other by resistors (7'', 8'', 9'', 10'', 11''), placed basically transversal to said first resistors. The spacing between said heating resistors depends on the power required to heat the inside mould cavity to the optimal temperature for blow moulding. The transversal heating elements (7'', 8'', 9'', 10'', 11''), or resistors, are placed near the end parts, top and bottom, of the mould. This placement is due to the fact that, to obtain perfect moulding results, it is necessary to have, in these areas, a certain amount of cooling (for example, to prevent distortions to the neck of the container or bottle) during forming and a greater amount of heat to compensate for the greater thermal dissipation caused by the significant curvature of the container.

Inside the shell half (1), there is another tubular resistor (3), together with a transversal resistor (7), of a second set of resistors, which is better shown in Fig. 3; the resistors of said second set are positioned analogously to the corresponding resistors of said first set.

Said first set of resistors can be eliminated, or disabled, if not required for the type of bottle to be made.

Figure 3 shows a detail view of the housing of the different tubular (3, 4, 5, 6) and transversal (7, 8, 9, 10) electric resistors found on the inside wall of half the shell (1).

If a greater amount of heat is required along the side wall of the container to be moulded than in the neighbouring areas (for example, to make significant constrictions, or deformations, to the section of the

container, or bottle, to be made), other transversal heating elements can be used in said areas. These additional elements can be similar to the others (7, 8, 9, 10), but some resistors (3, 4, 5, 6) can be shaped appropriately with loops. Obviously, said loops can be placed, without  
5 problem and as necessary, in every area of the mould.

Thus, it is easy to understand how tubular electric resistors, if necessary equipped with loops as specified above, connected to each other at the ends with transversal tubular electric resistors make it extremely simple to handle and control the production of containers,  
10 especially bottles, with the thermostabilizing treatment or heat-set process.